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July 1969

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COLLECTING CORN EARWORM PUPAE FROM
REARING CONTAINERS

Agricultural Research Service

UNITED STATES DEPARTMENT OF AGRICULTURE

ACKNOWLEDGMENT

We thank James H. Martin, agricultural engineering technician, Agricultural Engineering Research Division, U.S. Department of Agriculture, Tifton, Ga., for his valuable assistance in the development of this machine.

ABSTRACT

A machine was designed to collect corn earworm, Heliothis zea (Boddie), pupae from 1-ounce plastic rearing containers. The machine can also collect fall armyworm, Spodoptera frugiperda (J. E. Smith), pupae effectively. With the machine, one operator can collect as many pupae as 10 operators can collect by hand. The amount and dryness of the diet and the position of the pupa in the cup affect the efficiency of the machine.

COLLECTING CORN EARWORM PUPAE FROM

REARING CONTAINERS 1/

by

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One of the major costs of rearing large numbers of corn earworms, Heliothis zea (Boddie) in the laboratory, is labor, to collect the pupae from the rearing containers by hand. Harrell, Hare, and Burton 4/ developed equipment to collect the pupae of the fall armyworm, Spodoptera frugiperda (J. E. Smith), from the containers. Although the rearing containers and diet of the corn earworm are similar to those of the fall armyworm, this equipment caused high mortality when it was used to collect corn earworm pupae.

Techniques for mass rearing the corn earworm and the fall armyworm have been described by Burton 5/, Burton and Cox 6/, and Burton and Harrell 7/. A machine has been designed to collect either fall armyworm or corn earworm pupae from the individual rearing containers (cups) (fig. 1). It consists of a cup crusher, a revolving wire mesh cylinder, and conveyor belts.

To operate the machine, the operator places all the cups upside down on the horizontal conveyor, which conveys them between vertical belts (fig. 2). The vertical belts align the cups in single file and carry them between crushing rollers where the cap is popped from the cup. The serrated lips (0.12 inch) on the bottom edge of the crushing rollers apply pressure at a point not more than 0.37 inch from the top of the cup. Minimal cup crushing decreases injury to the pupae inside the cups. After the caps are popped from

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4/ Harrell, E. A., Hare, W. W., and Burton, R. L. Collecting pupae of the fall armyworm from rearing containers. *Jour. Econ. Ent.* 61(3):873-876. 1968.

5/ Burton, R. L. Mass rearing the fall armyworm in the laboratory. U.S. Dept. Agr. ARS 33-117, 12 pp. 1967.

Burton, R. L. Mass rearing the corn earworm in the laboratory. U.S. Dept. Agr. ARS 33-134, 16 pp. 1969.

6/ Burton, R. L., and Cox, H.C. An automated packaging machine for lepidopterous larvae. *Jour. Econ. Ent.* 59(4):907-909. 1966.

7/ Burton, R. L., and Harrell, E. A. Modification of a lepidopterous larvae dispenser for a packaging machine. *Jour. Econ. Ent.* 59(6): 1544-1545. 1966.

the cups and the cups are broken, the pupae and trash fall onto the horizontal conveyor belts. When they reach the end they fall through a chute into a rotating cylinder made of 0.5-inch mesh hardware cloth (fig. 3). Pupae and small trash fall through the wire mesh onto another conveyor belt which is slanted so that the pupae roll off its edge into a collecting bin, while the small trash is conveyed from the machine. The broken cups, caps, and large trash are discharged from the machine.

The machine has the potential to handle 100 cups per revolution of the vertical belts or 20,000 cups per hour. Although an operator could handle 50 cups per revolution, or 10,000 per hour, maximum, actual tests show a realistic potential of 7,000 cups per hour. But even at the present average working speed of the operators (about 5,000 cups per hour), the result is about 10 times the quantity which would result from manual collection.

Several factors affect the mechanical collection of corn earworms. The dryness and quantity of the unused diet are directly related to the percentage of pupae not collected by the machine (generally less than 5 percent). To reduce this percentage, sufficient diet for the development of only one larva is placed in each rearing container to prevent pupation in the diet itself. The egg and early larval stages of the corn earworm require high humidity. Eight to 10 days after the egg hatches, rearing containers are moved and placed upside down in a much less humid holding area.^{8/} This technique facilitates drying the unused diet and the waste materials and encourages pupation on the cap. Pupae collected after this regime appear more resistant to injury, and mortality caused by the machine is reduced to less than 10 percent. A similar regime is used for fall armyworms except that the cup must be on its side rather than upside down so the larvae can reach the diet.

Additional information about this machine and the techniques used is available from the authors.

8/ See footnote 7.

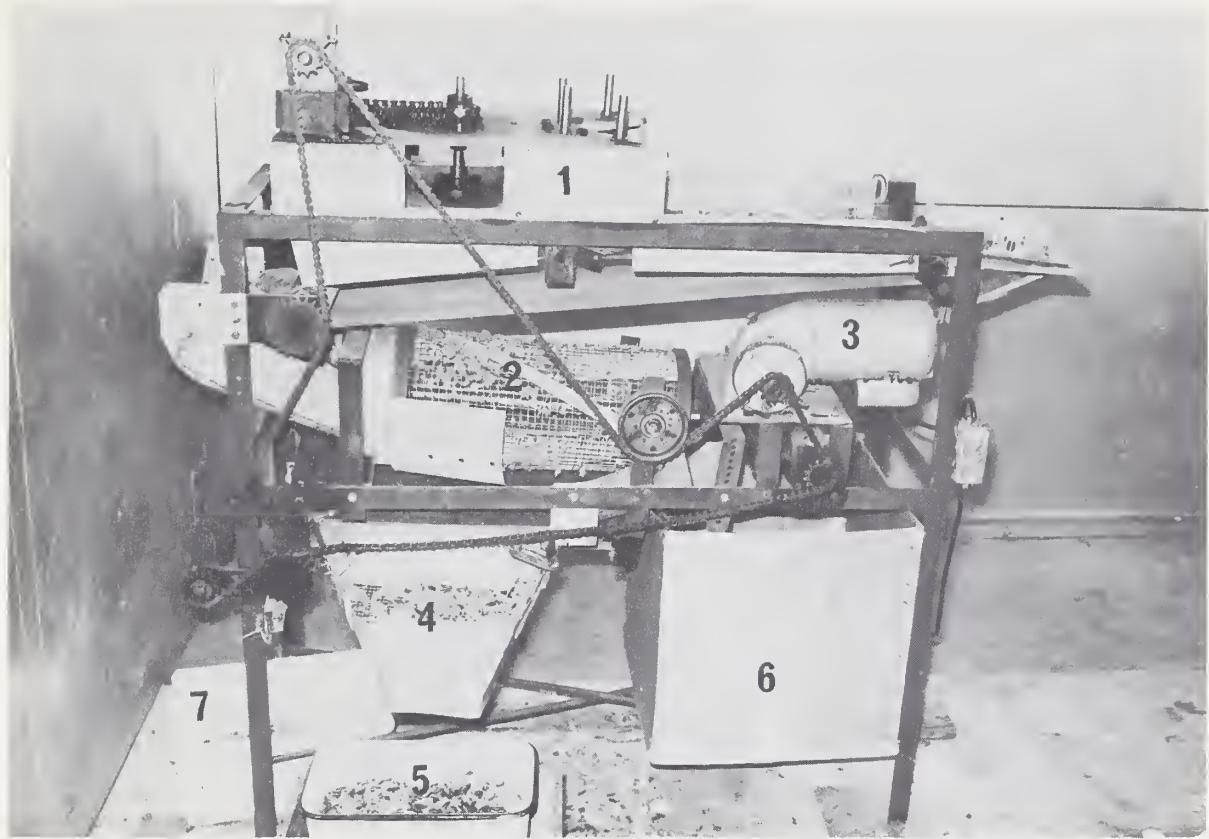


Figure 1.--Experimental pupae collector showing cup crusher section (1), revolving wire cylinder (2), drive motor (3), pupae collecting slide (4), collected pupae (5), container for large trash (6), and container for small trash (7).



Figure 2.--Top view of experimental pupae collector showing rearing containers with pupae (1), vertical belts (2), cup crusher section (3), and revolving wire cylinder (4).



Figure 3.--Bottom side view of pupae collector showing directional chutes for pupae (1), revolving wire cylinder (2), pupae collecting slide (3), and container for collecting large trash (4).

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